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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/501,616	05/25/2005	John Gordon Rushbrooke	920602-97103	2226

23644 7590 02/08/2006

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EXAMINER	
MIDKIFF, ANASTASIA	
ART UNIT	**PAPER NUMBER**
2882	

DATE MAILED: 02/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/501,616	RUSHBROOKE ET AL.	
	Examiner	Art Unit	
	Anastasia Midkiff	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *44-111* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *44-111* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *14 July 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities:

Page 8, Lines 18-36, describe the operation of a Linac source of a material discrimination system. In particular, Lines 25-26 recite, "the read-out system may also sample the output from crystals between the Linac pulse," and Lines 29-30 recite, "the Linac may be triggered on each alternate pulse only," wherein it is unclear what is meant by the term, "pulse." Is the pulse the actual pulsing of the beam, or is the pulse a signal to the Linac, which only allows the source to commence creating the beam when the Linac is "triggered?" This additionally raises the question of what is meant by, "Linac RF is preferably arranged to function in the untriggered condition throughout," in Lines 35-36.

Appropriate correction is required.

Claim Objections

Claims 44-108 are objected to because of the following informalities:

The claims are replete with narrative language, including the following phrases:

In Claim 44, "so that energy is transferred into the material at different depths depending on the energy of incident X-rays," and "unwanted background noise is reduced by,"

In Claims 48 and 54, "so as to sweep away electrons from that region,"

In Claim 51, "so as to remove low energy X-rays,"

In Claim 57, "to deflect stray electrons from the crystal,"

In Claim 63, "wherein electrons and scattered X-rays are removed by,"

In Claim 67, "to stop electrons produced by X-ray interactions downstream of crystal...depositing more energy in the front crystal,"

In Claim 70, "to prevent electrons produced by X-ray interactions downstream of the said first crystal...returning thereto,"

In Claim 73, "whose main purpose is to ensure that even the higher....respond preferentially to higher energy X-rays,"

In Claim 77, "as a result of multiple Coulomb scatter," and, "so that they are unable to reach the thin front crystal."

In Claim 80, "which increases the effective energy of the high energy X-ray component that is registered, and hence the magnitude of the material discrimination effect,"

In Claim 81, "to stop electrons produced by X-rays...reaching the rear crystal of the detector array,"

In Claim 83, "so as to prevent any left/right asymmetry in signal which can result...relative to one detector,"

In Claim 86, "to represent the high energy X-ray component,"

In Claims 87 and 91, "to prevent left/right asymmetry,"

In Claim 93, "in order to provide matched performance,"

In Claim 96, "and the choice of material...phosphorescence decay,"

In Claim 97, "so as to provide signals indicative of noise and crystal persistence,"

In Claim 102, "so as to overcome non-linear effects due to saturation,"

For Examination purposes, these phrases, being narrative in nature, are not given any patentable weight for the apparatus and/or system as claimed. Claims 45-47, 49, 50, 52, 53, 55, 56, 58-62, 64-66, 68, 69, 71, 72, 74-76, 79, 82, 84-86, 88-90, 92, 94, 95, 98-101, and 103-108 are objected to based on their dependency on the above listed claims.

With respect to Claims 49-50, 55-56, 58-59, 61-62, 65-66, 69-70, 74-75, 84-85, 89-90, 94-95, 100-101, and 104-105, these claims are further objected to as they provide for an intended use of apparatus, but, since the claims do not set forth any structure involved in said apparatus, nor any steps involved in the method for its use, it is unclear what apparatus and/or method applicant is intending to encompass. An object acted upon does not determine the structure of said apparatus, or the method for its use. For examination purposes, these limitations have not been given any patentable weight.

With respect to Claim 67, it is further objected to as, in lines 10-12, the phrase, "and is adapted to reduce the back scatter of electrons from the front crystal and to prevent electrons which have left the front crystal from returning thereto," is a repeat of lines 6-9 of the claim, and does not further limit the invention.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 44-59, 63-82, and 97-100 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: a source capable of generating x-ray radiation necessary to operate a material discrimination and/or X-ray inspection system in the manner required by claims 44, 51, 57, 63, 67, and 71. Claims 45-50, 52-56, 58-59, 64-66, 68-70, and 72-82 are rejected based on their dependency upon claims 44, 51, 57, 63, 67, and 71, respectively.

With respect to Claims 97-100, the omitted elements are: a device for pulsing the Linac, a device for synchronizing the read-out system to the Linac pulse, a triggering device for the Linac, and a device to synchronize the triggering with the pulsing of the Linac. Claim 100 is rejected based on its dependency upon Claim 97.

Claims 50, 56, 59, 62, 66, 67-71, 75, 81-85, 87, 90, 93-101, 105, and 110 are further rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to Claim 44, line 4 recites, "the first component," and line 6 recites, "the detector crystal," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--.

With respect to Claims 50, 56, 59, 62, 66, 70, 75, 85, 90, 95, 101, and 105, the limiting meaning of the phrase "in which X-ray energies in the range 18

to 25 MeV are employed," is unclear as the phrase indirectly limits the radiation of a source, wherein a source is not positively recited for these claims, rendering the claims indefinite.

With respect to Claim 63, line 3 recites, "the crystal detector," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--.

With respect to Claim 67, line 1 recites, "the first detector" wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--.

With respect to Claim 71, line 5 recites, "the thin front scintillation crystal," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--, or perhaps changing "front" to --first--. Alternatively, perhaps applicant meant line 2 to read, --a first scintillating crystal of a detector--.

With respect to Claim 77, line 2 recites, "said crystal," wherein it is unclear which crystal, front or downstream, is referred to.

With respect to Claim 81, line 2 recites, "the detector assembly," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--.

With respect to Claim 83, line 2 recites, "the thin front crystal," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--. Additionally, the phrase "as by" in Line 3 renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

With respect to Claim 86, the phrase "photodiodes, fibres, or other devices," in line 3 renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

With respect to Claim 87, the phrase "the crystal" in line 2 renders the claim indefinite because it is unclear which crystal (*i.e.,* front or rear) the phrase is referring to.

With respect to Claim 93, line 3 recites, "the front and rear scintillation crystals," wherein there is insufficient antecedent basis for this term. Examiner suggests changing "the" to --a--.

With respect to Claim 97, line 3 recites, "the read-out system," and line 4 recites, "from crystals," wherein there is insufficient antecedent basis for these terms. Examiner suggests changing "the" to --a--, and adding --of a detector-- or other appropriate term after "crystals."

With respect to Claim 98, lines 2-3 recite, "wherein the Linac is triggered on each alternate pulse only," wherein it is unclear what is meant by the terms, "pulse," and, "triggered." Is the pulse the actual pulsing of the beam, or is the pulse a signal to the Linac, which only allows the source to commence creating the beam when the Linac is "triggered?"

With respect to Claim 99, the limiting meaning of, "untriggered condition," cannot be ascertained and is, therefore, indefinite.

With respect to Claim 103, lines 3-4 recite, "when used with a particular Linac," wherein the limiting meaning of "particular" cannot be ascertained, and is, therefore, indefinite.

With respect to Claim 110, the phrase "such as" in Line 2 renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claims 68-69, 82, 84, 94-96, and 98-101 are rejected based on their dependency upon Claims 67, 81, 83, 93, and 97, respectively.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 63, 65, 67, 69, 71, 73, 74, 76-78, 86, 89, 102, 104, and 111 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Neale et al. (USP# 5,524,133).

With respect to Claim 63, Neale et al. teach an X-ray material inspection system for X-ray inspection (Title) using high energy X-rays (Column 4, Lines 38-

40), with at least one collimator (14, 16, and Column 7 Lines 27-30) positioned in front of a crystal detector (Figure 4, and Column 7 Lines 27-44).

With respect to Claim 67, Neale et al. teach a material discrimination system (Title) with a first detector component which is a thin scintillation crystal (Column 3, Lines 48-50) which registers the amount of X-ray energy deposited on the crystal wherein the amount of energy is essentially independent of the X-ray MeV energy (Column 3, Lines 50-51), with a low Z converter located after this thin crystal (Column 3, Lines 52-54), and wherein the low Z converter is situated between the thin front scintillation crystal and a thicker downstream scintillation crystal sandwich (Column 3, Lines 53-58).

With respect to Claim 71, Neale et al. teach a material discrimination system in which a low Z converter is located downstream of a first scintillating crystal of a detector (Column 3, Lines 44-54), and wherein the low Z converter is situated between the first scintillation crystal and a thicker downstream scintillation crystal sandwich (Column 3, Lines 53-58).

With respect to Claim 73, Neale et al. further teach a high Z, high-density converter behind the low Z converter (Column 3, Lines 44-58).

With respect to Claim 77, Neale et al. further teach scattered electrons traveling backwards out of the front crystal are absorbed in both the low and high Z converters (Column 3, Lines 44-63).

With respect to Claim 76, Neale et al. further tech the use of tungsten as a high Z converter for removing lower energy photons (Column 3, Lines 30-35).

With respect to Claim 78, Neale et al. further teach the high Z, high-density converters are interleaved with scintillating crystals (Column 3, Lines 55-57).

With respect to Claim 86, Neale et al. teach an X-ray inspection/material discrimination system (Title) detector (Column 2, Lines 66-67) comprising a front thin crystal and a rear thick crystal sandwich (Column 3, Lines 44-58) wherein the latter is read out by a plurality of photodiodes or fibres (Column 3, Lines 64-65) which sample at different depths in the beam direction (Column 3, Lines 39-43), and signals from the sampling devices are added (Column 3, Lines 59-67).

With respect to Claim 102, Neale et al. teach an X-ray material discrimination system for X-ray inspection (Title) using high energy X-rays (Column 4, Lines 38-40), which incorporates a Linac [linear accelerator] (10, and Column 10, Lines 55-56), in which the channels are normalized (Column 6, Lines 48-52), and calibration is performed by increasing the X-ray beam flux by known increments (Column 11, Lines 11-15).

With respect to Claims 65, 69, 74, 89, and 104, Neale et al. further teach the system and detector used for medical and non-destructive imaging/testing purposes (Column 6, Lines 10-14).

With respect to Claim 111, Neale et al. teach a method of testing for the presence of a material whose effective Z is different depending on whether high or low energy X-rays are employed (Column 9, Lines 54-59), comprising the steps of inspecting an object under test using high energy X-rays and low energy X-rays and noting the effective Z of the constituents of the object at both energies

(Column 2, Lines 10-18), comparing the values of Z obtained from the two tests for the constituents in the object (Column 2, Line19), and using a look-up table of known Z ratios for materials using the two X-ray energies to determine the identity of each constituent (Column 2, Lines 7-10 and 20-22).

Claims 51, 52, and 55 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Shefer et al. (USP# 4,887,604).

With respect to Claim 51, Shefer et al. teach an X-ray inspection system (Column 3, Lines 42-46) in which a thin X-ray absorber (40) is placed upstream of an object under investigation to remove low energy X-rays (Column 4 Lines 67-68, and Column 5 Lines 1-4).

With respect to Claim 52, Shefer et al. further teach that the lower limit for X-rays removed by absorber (Column 4 Lines 67-68, and Column 5 Lines 1-4) is 0.5 MeV (Column 3, Lines 62-63).

With respect to Claim 55, Shefer et al. further teach the system is used for medical and non-destructive testing purposes (Column 2, Lines 50-52).

Claims 57 and 58 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent to Ochiai et al. (USP# 4,887,604).

With respect to Claim 57, Ochiai et al. teach an X-ray inspection system (Column 1, Lines 18-21) wherein a magnetic field (17) is applied to the region in front of a detector crystal (101) to prevent back scattered electrons from impinging on the detector (Column 2, Lines 53-60).

With respect to Claim 58, Ochiai et al. further teach the system is used for medical and non-destructive testing purpose (Column 1, Lines 8-13).

Claims 93 and 94 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Bjorkholm (USP# 4,511,799).

With respect to Claim 93, Bjorkholm teaches a material discrimination detector for use in an X-ray discrimination system for x-ray inspection using high energy X-rays (Column 2 Lines 32-40, and Column 3 Lines 52-57), wherein a front scintillation crystal (41) and a rear scintillation crystal (51) are cut from the same ingot of material (Column 4 Lines 60-68, and Column 5 Lines 1-36).

With respect to Claim 94, Bjorkholm further teaches the system and detector used for medical and non-destructive imaging/testing purposes (Column 1, Lines 9-23).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 44, 46, 47, 60, and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al. in view of U.S. Patent to Majewski et al. (USP# 5,960,057).

With respect to Claims 44 , 46, 47, and 60, Neale et al. teaches an X-ray inspection system (Column 1, Line 7) which incorporates a detector that operates on the electromagnetic cascade effect produced in suitable materials when bombarded by X-rays (Column 2, Lines 53-67), wherein the first component the X-rays impinge upon comprises a relatively thin crystal (Column 3, Lines 48-50).

Neale et al. does not teach placing a vessel containing a fluid whose density is less than that of air in front of the detector crystal, and does not teach that fluid is helium, which is maintained at atmospheric or slightly greater than atmospheric pressure.

Majewski et al. teaches an X-ray inspection system (Abstract, Lines 4-6) wherein a vessel (7) containing a fluid whose density is less than that of air (Column 4, Lines 50-57), in front of a detector (6, Figure 5), wherein said fluid is the low Z gas helium (Column 4, Lines 53-57), wherein helium is a gas when maintained at atmospheric or slightly greater than atmospheric pressure, to limit absorption and scattering of X-rays between an object being inspected (1) and the detector (Column 4, Lines 53-57).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the helium-filled chamber of Majewski et al. in the system of Neale et al. to limit unwanted absorption and scattering of X-rays between the object and the detector, improving imaging quality, as taught by Majewski et al. (Column 2, Lines 60-65).

Additionally, Examiner notes that applicant places no criticality on maintaining the fluid at atmospheric or slightly greater than atmospheric pressure.

With respect to Claim 61, Neale et al. further teach the system and detector used for medical and non-destructive imaging/testing purposes (Column 6, Lines 10-14).

Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al. and Majewski et al., as for Claim 44 above, and in further view of U.S. Patent to Short et al. (USP# 6,920,203).

With respect to Claim 45, Neale et al., as modified by Majewski et al., teach most of the necessary elements of the claimed invention, and Majewski further teaches that vessel is formed of films transparent to x-rays to allow radiation to impinge upon detector (Column 5, Lines 26-30) but they do not teach that vessel comprises a bag.

Short et al. teach an attenuating filter in the form of a fluid-filled bag employed between the source and detector (Column 2, Lines 22-25), accommodating the complex and unique shapes of patient anatomy being studied, improving the image quality by controlling X-ray flux (Column 2, Lines 5-33).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the bag-style of Short et al. in the vessel of Neale et al. and Majewski et al. to provide precise control of radiation impinging on detector in a

flexible collimator that will accommodate the unique sizes and shapes of objects examined.

Claims 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claim 44 above, in view of U.S. Patent to Ochiai et al. (USP# 6,653,637).

With respect to Claim 48, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach applying a magnetic field in the region in front of a detector crystal.

Ochiai et al. teach an X-ray inspection system (Column 1, Lines 18-21) wherein a magnetic field (17) is applied to the region in front of a detector crystal (101) to prevent back scattered electrons from impinging on the detector (Column 2, Lines 53-60), preventing the back scattered electrons from creating background noise (Column 2, Lines 5-24).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the magnetic field of Ochiai et al. in the system of Neale et al. to reduce background noise, improving image resolution, as taught by Ochiai et al. (Column 2 Lines 5-24, Column 4 Lines 66-67, and Column 5 Lines 1-5).

With respect to Claim 49, Neale et al. further teach the system and detector used for medical and non-destructive imaging/testing purposes (Column 6, Lines 10-14).

Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent to Shefer et al., as applied to Claim 51 above, in view of U.S. Patent to Short et al. (USP# 6,920,203).

With respect to Claim 53, Shefer et al. teach a high Z absorber of cerium (Column 5, Lines 4-7) for removing high-energy x-rays before they reach the object analyzed (Figure 1, Items 42 and 46).

Shefer et al. do not teach said absorber is made of lead, which is 10 mm thick.

Short et al. teach the use of lead as a material substantially opaque to X-rays for use in filtering X-ray radiation (Column 8, Lines 2-4).

It would have been an obvious matter of design choice to choose lead rather than cerium as the high Z material, since applicant has not disclosed that lead solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with cerium. Additionally, Shefer et al., as modified by Short et al., discloses the claimed invention except for a thickness of 10 mm. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a thickness of 10 mm, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)*, and applicant has not assigned any criticality to the value of, or stated any long-standing problem in the art solved by using the value of, 10 mm for the lead absorber.

Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shefer et al., as for Claim 51 above, in view of U.S. Patent to Ochiai et al. (USP# 6,920,203).

With respect to Claim 54, Shefer et al. teach most of the necessary elements of the claimed invention, but they do not teach applying a magnetic field in the region in front of a detector crystal array.

Ochiai et al. teach an X-ray inspection system (Column 1, Lines 18-21) wherein a magnetic field (17) is applied to the region in front of the crystal (101) of each detector (101R, 101C, 101L) in an array of detectors (Figure 10) to prevent back scattered electrons from impinging on the detector (Column 2, Lines 53-60), preventing the back scattered electrons from creating background noise (Column 2, Lines 5-24).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the magnetic-field-shielded detector array of Ochiai et al. in the system of Shefer et al. to reduce background noise, improving image resolution, as taught by Ochiai et al. (Column 2 Lines 5-24, Column 4 Lines 66-67, and Column 5 Lines 1-5).

Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as for Claim 63 above, in view of U.S. Patent to Short et al. (USP# 6,920,203).

With respect to Claim 64, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach a lead collimator.

Short et al. teaches an X-ray imaging system (Column 3, Lines 20-27), with a collimator in front of a detector (Column 2, Lines 22-25), wherein the collimator is a lead collimator which is substantially opaque to high energy X-rays (Column 7 lines 43-52, and Column 8 Lines 1-7).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the lead collimator of Short et al. in the apparatus of Neale et al., to provide a collimator which is substantially opaque to high energy X-rays for shaping the beam into a desired geometry, as taught by Short et al. (Abstract Lines 1-3, and Column 8 Lines 1-7).

Claims 68 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claims 67 and 71 above, in view of U.S. Patent to Shefer et al. (USP# 4,887,604).

With respect to Claims 68 and 72, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach that the low Z converter is aluminum.

Shefer et al. teach a low z converter filter for X-rays made of aluminum (40) which is suitable for attenuation of the low energy components of an X-ray beam.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum converter filter material of Shefer et al. as the low z converter between the crystals of the detector in the system of Neale et al., providing attenuation of low energy X-rays before they reach the high energy

crystal, improving the signal-to-noise ratio of detector output, as taught by Shefer et al. (Column 5, Lines 7-10).

Claims 79, 80, 83, 84, 87, 88, and 91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claims 78 and 86 above, in view of U.S. Patent to DiFilippo (USP# 6,078,052).

With respect to Claims 79, 80, 83, 87, 88, 91, and 92, Neale et al. teach most of the elements of the invention, including adding the outputs of multiple photodiodes or fibers, but do not teach a pair of photodiodes or fibers connected to each scintillation crystal on opposite sides.

DiFilippo teaches a scintillation detector (Title) wherein the scintillation crystal (12) is read out at all points from opposite sides (Figure 2) by optical fibers (14, 16), to prevent loss of detectable photons from the crystal (Column 3, Lines 21-27).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the read out system of DiFilippo in the system of Neale et al., capturing all detectable photons and improving spatial resolution and energy resolution of the detector, as taught by DiFilippo (Column 3, Lines 21-27).

With respect to Claim 84, Neale et al. further teach the system and detector used for medical and non-destructive imaging/testing purposes (Column 6, Lines 10-14).

With respect to Claim 92, Neale et al. further teach that crystals are read out by plastic light guide fibres leading to a CCD (Column 6, Lines 19-23), with all

read-outs added to produce a signal corresponding to the high energy x-ray component (Column 3, Lines 59-67).

Claims 81 and 82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claim 78 above, in view of U.S. Patent to Williams et al. (USP# 6,294,791).

With respect to Claims 81 and 82, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach an absorber located at the rear of a detector assembly, wherein the absorber is made of aluminum.

Williams et al. teach an X-ray material discrimination system (Abstract) wherein there is an absorber (40) in the form of an aluminum beam stop (Column 3, Lines 56-62), which provides shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum beam stop of Williams et al. in the system of Neale et al. to provide shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4), as taught by Williams et al.

Claim 96 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bjorkholm, as applied to Claim 93 above, in view of Neale et al.

With respect to Claim 96, Bjorkholm teaches most of the necessary elements of the claimed invention, but does not teach the material is CsI (Cesium Iodide).

Neale et al. teach the use of caesium [sic] iodide as the material used for detector scintillation crystals (Column 8, Lines 7-20), which provides strong energy dependence for X-rays absorbed by the crystals (Column 8, Lines 16-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the cesium iodide crystals of Neale et al. in the system of Bjorkholm to improve material discrimination at low X-ray energies by increasing the energy dependence of X-ray absorption in the crystals, as taught by Neale et al. (Column 8, Lines 7-20).

Claims 97-98 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent to Grodzins et al. (USP# 6,151,381) in view of U.S. Patent Application Publication to Rivard (PGPUB# 2003/0204126).

With respect to Claims 97 and 98, Grodzins et al. teach a material discrimination system for X-ray inspection (Figure 1, and Column 2 Lines 37-40) of high energy X-rays which includes a Linac (50) and a detector with crystals (26, 28), wherein a read-out system is synchronized to the Linac pulse with one read-out cycle for each pulse (Column 5 Lines 37-50, and Column 6 Lines 46-50).

Grodzins et al. do not teach that the read-out system also samples the output from detector crystals between each Linac pulse.

Rivard teaches a radiation read-out system for a pulsed radiation source which samples signals during "dead time" (non-pulse-time) to obtain a background count rate, and subtracts this count rate from subsequent detector readings for samples examined (Paragraph 218).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the background calibration of Rivard in the system of Grodzins et al. to remove background noise from the detector and improve accuracy of sample readings, as taught by Rivard (Paragraph 218).

Claims 103, 104, and 106-110 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as for Claim 102 above, in view of U.S. Patent to Newman et al. (USP#5,420,441).

With respect to Claims 103 and 107, Neale et al. teach most of the necessary elements of the claimed invention, but do not teach a step wedge of absorbing material with increments of thickness chosen to yield fixed decrements of transmission between 90% and 10%.

Newman et al. teach a lead foil step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed incremental percentages (Column 8, Lines 33-40) which normalizes detector photodiodes by calibration of signal-to-noise ratio of a photodiode detector exposed using calibration wedge signal value vs. average thickness (Column 8, Lines 47-67) and calibration of spatial resolution of photodiode detector exposed using calibration wedge (Column 9, Lines 7-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge calibration of Newman et al. in the detector system and method of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

With respect to Claim 104, Neale et al. further teach the system and detector used for medical and non-destructive imaging/testing purposes (Column 6, Lines 10-14).

With respect to Claims 106 and 108, it would have been an obvious matter of finding useful material, subject to availability, to choose PTFE as the step wedge material, since applicant has not disclosed that PTFE solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with other x-ray attenuating materials.

With respect to Claim 109, Neale et al. teach a method of material discrimination using X-rays (Abstract) which is performed by generating calibration curves of material discrimination effect (MD) verses transmission (T) (Column 9, Lines 39-42, and Figure 1), wherein the MD effect is derived from the lower and high energy signals (Column 10, Lines 16-18).

Neale et al. does not teach calibration is performed using step wedges of suitable absorbing material, and that T is 1 for zero absorption and 0 for completely absorbing objects.

Newman et al. teach a lead foil step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed

incremental percentages (Column 8, Lines 33-40) which normalizes detector photodiodes by calibration of signal-to-noise ratio of a photodiode detector exposed using calibration wedge signal value vs. average thickness (Column 8, Lines 47-67) and calibration of spatial resolution of photodiode detector exposed using calibration wedge (Column 9, Lines 7-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge calibration of Newman et al. in the detector system and method of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

Neale et al., as modified by Newman et al., discloses the claimed invention except for noting transmission is 1 for zero absorbance and 0 for completely absorbing objects. It would have been obvious to one having ordinary skill in the art at the time the invention was made to set these limits for transmission based on absorbance since it was known in the art to do so, and most spectrometers are set up in this manner.

With respect to Claim 110, Neale et al. further teaches a range of calibration curves for different materials (Figure 1, and Column 9, Lines 52-62), whereby the effective Z of an unknown material can then be found by comparing its MD effect and T value with the corresponding values of known materials, and then interpolating (Column 10, Lines 38-44).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anastasia Midkiff whose telephone number is 571-272-5053. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ASM
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